

***SHRUTI* IN CONTEMPORARY HINDUSTANI MUSIC**

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Abstract

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Intonation, and in particular the concept of shruti, has been one of the central subjects in Indian art music for over two millennia. Although the awareness of a discrepancy between the ancient treatises and contemporary practice had been growing from at least the mid-17th century, it was only in the latter half of the twentieth century that theories of intonation based on empirical research emerged.

The microtonal subtleties of shruti are apparently significant with respect to raga-specific ornamentation. The melodic graphs presented in this study clearly show that the use of the tonal space in ragas that are supposed to employ shrutis is not about fixed, pinpoint intonations. The artistes rather attempt to carve out melodic shapes, in which the precise positions of the movements can vary considerably. There is variation from one artiste to another in the same raga and also within a single performance.

Introduction

In India, special attention has been given to the aspect of ‘pitch’ in music. Bharata (200 BC- 200AD) pioneered the concept of *shruti*, which was either elaborated, criticized or commented upon by many musicologists after him. The term ‘*shruti*’ denotes an audible sound free from resonance and which is capable of being individually perceived, recognized and reproduced. According to Sharangdeva (13th century), *shruti* signifies a pitch value, which contributes to the musicality of the tone, yet by itself is devoid of any tonal colour¹. Even today, Indian musicians attach great importance to correct intonation, often characterized in terms of *shruti*. An important part of their training and practice are aimed at developing a correct sense of *raga*-specific intonations.

Shruti is intimately linked to the concept of *svara*. Whereas *svara* is a musical note or scale degree, *shruti* is a more subtle division of the octave. From early times onward an octave was supposed to contain twenty-two *shrutis* and the relation between *shruti* and *svara* has been a major source of confusion. It has not been uncommon to refer to *shrutis* as quarter-tones or microtones, but evidently, twenty-two *shrutis* divided over seven *svaras* in an octave raises a mathematical question. Although the awareness of a discrepancy between the ancient treatises and contemporary practice had been

¹ R. K. Shringy and Premlata Sharma, trs., op. cit., vol.I, p. 407

growing at least from the mid-17th century, it was only in the latter half of the twentieth century that theories of intonation based on empirical research emerged².

When Nicholas Cook says that “Indian and Chinese music is often performed between the notes”³ he not only touches upon a fundamental characteristic of such musics but also raises an important question about the very nature of melodic movement. With fixed-pitch instruments like the harmonium and systems of writing music like the Western staff notation many people have come to think of melody as a sequence of discrete pitches. These discrete pitches are not only used to describe melody in fixed-pitch instruments, they have become the parameters in a model for describing “music between the notes” as well. Thus, a particular glissando would be described as a transition from *ga* to *re*. The Western bias for discrete pitches is not only fed by the prominence of keyboard instruments, it also has a long history of obsession with ratios. From Pythagoras to Helmholtz, Western thinking about melody is marked by a reduction of the continuous tonal space to a limited series of points. Although Indian music also uses a similar abstraction by defining seven notes, twelve semitones and twenty-two *shrutis*, it must be stressed that from early times these may have been considered regions rather than points.⁴ Moreover, as William Jones noted in 1784 “[the Indians]leave arithmetic and geometry to the astronomers and properly discourse music as an art confined to the pleasures of imagination”⁵. Since the times of Jones however, the interaction between Western and Indian musicology has resulted in an enormous body of highly speculative theorizing about pinpointed note positions defined in terms of string lengths, frequency ratios or cents (vide Levy 1982, Rao and Meer 2004).

Most of the authors who approached this subject have attempted to explain the ancient system of 22 *shrutis* in terms of a theory of just intonation or to reformulate the ancient system in term of frequency ratios. Many of these authors also tried to show that the Indian music of their times still relied on the ancient system of 22 *shrutis* or, if it didn’t, that it should! There were however a number of dissidents. In fact, as noted above, William Jones championed the Indian non-mathematical approach. Captain Willard, in 1834, also expressed his doubts about the real nature of *shrutis*⁶. The great Indian musicologist V.N. Bhattacharya challenged the validity of ancient musicological treatises for contemporary music and considered the modern tonal system of Indian music to be essentially a 12-tone system. Bhattacharya’s disciple, Ratanjankar, thought that the precise position of the *shrutis* depended on the context. Jairazbhoy and Stone, the first to use modern methods of measuring pitches, came to completely reject the very notion of *shrutis* playing a role in intonation. Their conclusion was that intonation in North Indian music was very inconsistent and could best be described as tempered ± 30 cents. Their findings were confirmed by Jairazbhoy’s disciple Levy, who performed more measurements. Extensive measurements, done with advanced technology by Bel, Arnold, Meer and Rao led to a more detailed view. On the one hand they concluded that intonation could be quite precise and certainly more accurate than “tempered ± 30 cents”. On the other hand, explaining contemporary intonation on the basis of the ancient 22 *shruti* system was shown to be a meaningless endeavour (Meer 2000).

In the present paper we shall try to further elucidate this question and demonstrate that the crux of the problem lies in the now centuries old fallacy of thinking of melody in terms of fixed positions of intonation. These fixed positions have been used as parameters in describing melodic movement. Moreover, it has been implicitly assumed that these abstract positions can be extracted from “real live” music. The first efforts of such extraction were based on the idea that musicians tune their

² See for instance Jairazbhoy and Stone 1963, Levy 1982, Bel and Arnold 1983, Rao 1990, Meer 2000.

³ Cook 1998: 55-59

⁴ Rowell 1998: 151.

⁵ Jones 1794: 135

⁶ Willard 1934: 41

instruments according to the theoretical backbone of the scale. In 1982 Bel designed a *shruti* harmonium in which each key could be separately tuned and measured, leading however to very inconsistent results. Bel thought this could be due either to the specific timbre of the instrument or because the context of performance was missing. He therefore suggested that the only valid approach was to measure notes in actual performance and in 1983 designed the Melodic Movement Analyser for this purpose. All the pitches used in a performance could be displayed in a histogram and the peaks in such a histogram would ideally represent the scalar backbone of the *raga* being performed. It appeared that the peaks were often quite vague and moreover, that their position varied from performance to performance and also within sections of a single performance. To narrow the peaks down a windowing system was used, which allowed only notes of a specified duration to be included in the measurements. Although this resulted in narrower peaks it did not display a greater consistency.

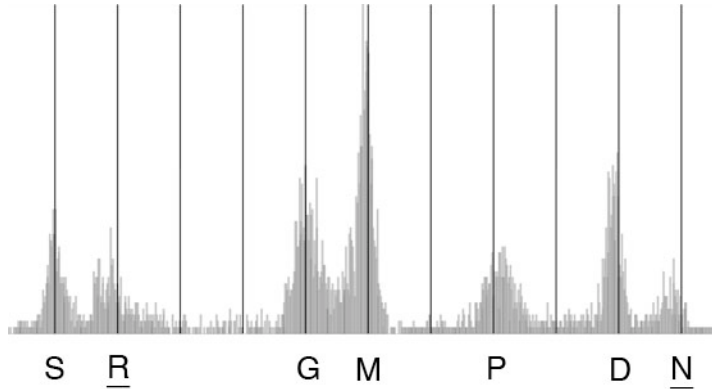


Figure 1: Tonagram of Ahir bhairav by Kishori Amonkar

Figure 1 (a tonagram made with PRAAT) illustrates this, see for instance the spread of *Re*, *Ga* and *Ni* and the unlikely position of *Pa* (the recording uses *Ma*-tuning!). In fact, so far we can only conclude that there is no evidence at all of the existence of a uniform and unequivocal scalar backbone of *ragas* and possibly such a fixed backbone is a misconception.

In stead, we propose that a *raga* consists of a series of melodic shapes that are drawn against the background of the full and continuous tonal space, with the overtones of the *tanpura* as reference points. As a designation for such melodic shapes we propose the term *toneme*. This term obviously derives as a parallel to the linguist's phoneme, and could be defined as the smallest unit of melodic music. In fact, it seems adequate to compare the letters of the alphabet to the notes of music – CDE ..., do re mi ..., *Sa Re Ga*. In Hindustani music the most important toneme classes are *mind*, *andol*, *kan* and *murki*. *Svara* (as a prolonged steady pitch) also should be considered a toneme. The discussion of tonemes in Indian music is important for two reasons. First, because they are essential in the construction of a *raga*. Ratanjankar calls them *svara-sangatis* or *sancharas*: “It means *svara-sangatis*. These are little blocks of *svara* passages - *svara sancharas* that constitute 80% of the *raga*”⁷. Secondly, the idea of tonemes can help us to abandon the note-based view of melodic music. We feel there is strong evidence to suggest that dissecting a toneme into its constituent notes results in a very imperfect and incomplete description. Anyone trained in Indian music knows that describing an *andol* in Darbari Kanada or a *mind* in Sindhura in terms of pinpoint pitch positions is impossible. Only in the direct transmission from teacher to disciple can these shapes be understood. But even the simplest *murki* has such a complex inner structure that it defies description in notes. Of course, the same is true for alphabets and phonemes in written and spoken language respectively. As Ratanjankar put it: “Even in the script of worded language accents, emphases, pauses, pitch of the voices, and strength have to be filled up in actual speaking. The script is certainly not a perfect representation of the spoken sentences. Why then find fault with representation of the spoken sentence. Why then find

⁷ Ratanjankar 1952: 57

fault with written music?”⁸ It must be reiterated that so-called “steady” or “held” notes are only a specific type of toneme, which takes up a relatively minor portion of a full performance in the slow parts. Moreover, steady notes are rarely as steady as they may seem to the lay listener. G. H. Ranade already stressed that steady notes often contain imperceptible vibratos and other changes in timbre and volume.⁹

***Shruti* and in Betweenness**

In Indian music, graphs of pitch against time (referred to as *melograms*) of voice or instruments without fixed pitches not only show many transitions in a bewildering variety of shapes, but also an enormous variability in the production of supposedly steady notes that represent the scalar backbone. To cite G.H. Ranade: “... one need not be surprised if such [sound-curve] photographs reveal that the so-called fixed notes of a *raga*-scale either develop enharmonic forms or often oscillate between certain pitch-limits and undergo many other changes, in the course of the different stages of the development of one and the same *raga*.”¹⁰ Ranade also suggests that timbre and volume play an equally important role in the total impact of a note.¹¹ He further quotes Parshvadeva (12th century) on the subject of *gamaka*: “When in a song a note peeps over from the region of its own legitimate *shrutis*, a shade into the region of its (higher or lower) neighbours is there”.¹² On this basis Ranade concludes that *shruti* and *gamak* are not separate entities.¹³

A concept related to *shruti*, which apparently was in vogue around the end of the 19th century, is *murcchan*. Pingle for instance describes *murcchan* as a quarter tone that appears in *mind*.¹⁴ He also states that “Those who have practiced Indian music can easily understand why Darbari Kanada is reduced to Sind Bhairavi by eliminating only the *murchhanas*. A mere taking away of the *murchhanas* changes Sahana Kanada into Kafi, Jogiya into Bhairavi, Bageshri Kanada into Bahar.”¹⁵ Ratanjankar compared music to language and made it clear that the performance of a *raga* depended on correct *ucchar* (pronunciation)¹⁶ or *lagadant*.¹⁷ He says: “written music has always to be filled by such embellishments which are to be learnt by practice and always much to be “read between the lines”¹⁸ and “Correct expression of musical note refers to graces of music which are known in the

⁸ Ratanjankar 1960: 107

⁹ Ranade 1957: 43.

¹⁰ Ranade 1951: vii

¹¹ Ranade 1957: 42

¹² Ibid: 43

¹³ Ranade 1957: 43.

¹⁴ Pingle 1898 : 31, 56. *Murcchan* used in this context is a concept quite different from the ancient *murcchana* (with long “a”), which is best translated as “mode”. *Murcchan* (literally “swoon”) in the sense of an ornamentation in which microtonal variations occur is found only in authors of the end of the 19th and beginning of the 20th centuries: Banerji (1881???), Pingle (1898), Ichalkaranjikar (1883), Tagore (1865), Deval (1918). Roy Chaudhuri (2000) in his *The Dictionary of Hindustani Classical Music* (75), also refers to this obsolete use of the word *murcchan*.

¹⁵ Ibid: 40

¹⁶ Ratanjankar 1960: 42

¹⁷ Ratanjankar 1952: 57. *Lagadant* “... means *svara-sangat*. These are little blocks of *svara* passages-*svara sancharas* that constitute 80% of the *raga*” (Ratanjankar 1952: 59).

¹⁸ Ratanjankar 1960: 42, 107

sastras by the word *gamaka*, which give a note its correct expression and correct degree of pitch as required for correct rendering of a *raga*”¹⁹. B.C. Deva has formulated it thus: “The difficulty here is that Indian music is almost totally ‘continuous’: one tone moving into another. The ‘same’ note acquires differing pitch values in *aroha* and *avroha*. And then there is the tantalizing *gamaka* always keeping the note on the move. These necessitate the use of equipment and techniques for measuring a ‘continuous’ flow of sound. They may also point towards the need for a newer definition of *shruti*.”²⁰

That *shruti* could relate to “music between the notes” is not entirely a modern phenomenon. Matanga (6th - 9th century?) sums up no less than five interpretations of the relation between *shruti* and *svara*. It is highly significant that Matanga arrives at the conclusion that *svara* is manifested through the *shrutis*, that *svaras* are separated from each other by bands of *shrutis*. As Rowell has pointed out, “this is in striking contrast to early Western musical thought, in which pitches were traditionally conceived as points”.²¹ In Abhinavagupta’s commentary on the *Natyashastra*, *shruti* appears in the context of ornamentation, with the aim of heightening the emotional impact of a song. In addition he indicates that *shrutis* have a time value, which would obviously be impossible if it were only a tuning position.²²

B.C. Deva’s idea that *shrutis* are pitch areas rather than exact pinpoints is strengthened by the work of Levy, Bel and Rao. Deva also notes that it is practically impossible to measure all the pitch variations of *gamaks* (expansive oscillatory movements) and *minds* (glides).²³ While earlier musicologists have occasionally hinted at the fact that for musicians *shrutis* are part of specific ornamentations, Deva makes an explicit case for this approach to the concept. As such, he includes in his model that which performing musicians already know and have been practicing all along, the *shrutis* as a pitch area rather than an exact pinpoint.²⁴

A.D. Ranade (1971) has elaborated this concept further by suggesting that a *svara* has a tonal center and a periphery. He specifies that the tonal range is related to the melodic context and based on this model, he attempts to define finer levels of intonations such as *kansur* (marginally off pitch) and *besur* (clearly off pitch).

The enormous amount of data processed by the MMA (Melodic Movement Analyzer) developed by Bernard Bel confirmed that intonation certainly is not a pin-point phenomenon. It supported the views of Deva, Jairazbhoy, Stone and Levy that pitch in performance occurs in tonal ranges rather than exact points.²⁵ Using the MMA, Bel, Arnold, Bor and Van der Meer showed that musicians achieve meaningful differences in intonation in different *ragas*.²⁶ Van der Meer had earlier suggested that the term *shruti* should be understood as a tonal configuration rather than a deviation from a pre-determined ratio, along the lines earlier expressed by G.H. Ranade.²⁷ Comparing the varying positions of *komal Ga* in *ragas* Sindhura, Bahar, Malhar, Suhakanada and Barva he suggested that totality of

¹⁹ Ibid: 94

²⁰ Deva 1974: 21

²¹ Rowell 1998: 151.

²² Ramanathan 1980: 103-4.

²³ Deva 1967: 109 and 1965: 59.

²⁴ Deva 1965: 64. This observation is further strengthened by the experimental findings of Levy, Bel and Rao.

²⁵ Deva 1965: 23. Arnold *et.al* 1984: 47.

²⁶ It is pointed out that even some of the data presented by Levy could have led him to similar conclusions, ISTAR 3-4, 1985: 47.

²⁷ Meer 1980: 10.

the sound of a note in a *raga* is defined by the scale, melodic pattern and the specific melodic treatment.²⁸ Rao's analysis (1990) using the MMA provided further support to the view that pitch values for different notes are neither rigidly fixed nor randomly varying, and in fact, the musicians do seem to conform to a particular range of pitch values for a given *raga*. Further, the same performances were examined using another independent system (LVS) based on contemporary theory of pitch perception,²⁹ which validated the results concerning pitch positions. The viewpoints expressed by Bhatkhande, Ratanjankar, Deva, Van der Meer etc. about the pitch being related to melodic context have been experimentally verified beyond doubt.³⁰ Rao's conclusions such as "...the pitch values assumed for different notes are neither rigidly fixed nor randomly varying and in fact, the musicians do seem to conform to a particular range of pitch values for a given *raga* ..." are further strengthened in the present paper by providing specifications of tonal range assumed by a given note in various situations of melodic context and treatment, even within a given *raga*.

Present Position

As pointed out earlier, the crux of the problem lies in the now centuries old fallacy of thinking of melody in terms of fixed positions of intonation. Musicologists often presumed that the note in question should be performed at a specific - non-standard - pitch.³¹ This confusion can easily be understood, as terms like *ati komal* (extra low) and *tivratar* (extra high) are often used in this context by performing musicians.

Rao's study also reveals that codification in terms of pitch values alone is impossible, especially in the case of embellishments involving intricate tonal movements. Thus it supports van der Meer's observation that the human ear perceives pitch only in a particular context and it would be wrong to think exclusively in frequency ratios.³² For such intonations the melodic contours seem to be musically more significant than mere pitch information in terms of frequency and the melodic shape of a note has to be studied.³³ During performance the musicians' efforts are constantly directed towards achieving specific tonal configurations. When a performer succeeds in this endeavour, knowledgeable audiences immediately respond in appreciation, clearly relating the specific tonal configuration with the essence of the given *raga*.³⁴ As suggested by Bake, Ratanjankar and emphasized by Van der Meer, the microtonal subtleties of *shruti* can be considered meaningful and significant with respect to *raga*-specific ornamentation in present-day performance practice.

²⁸ Ibid.: 18-19.

²⁹ For more information, vide Rao 2000: 65.

³⁰ These results are based on the pitch measurements of "standing notes" that are audibly perceived as "steady notes" (or the notes which are judged as *khada sur*). The criteria for measuring a steady note has been evolved after having realized the difficulty associated with measuring accurately "the ideal pitch" of a note of shorter duration, linked by either descending or ascending melodic contexts. In Indian music glides and undulations are so common that only 10-20 % of even the *alap* section of a performance consists of so called 'steady notes'.

³¹ The opposed views are well described by Rabindralal Roy, who speaks of the mechanical and the aesthetic aspects of *shruti*. (Official Report of the XXXIIIrd Madras Music Conference, 1959, 39).

³² Meer 1980: 10.

³³ The expression melodic shape implies pitch in time and does not refer to the form of objects in space.

³⁴ It is not uncommon to have appreciative remarks such as "*Kya Gandhar lagaya hain*" meaning "*What an intonation of Gandhar*" from a knowledgeable audience.

Acoustical Analysis of *Shruti*

Contemporary musicians use the word *shruti* in conjunction with highly specific ornamentations of particular notes in particular *ragas*. Thus, they speak of the *shruti* of *komal gandhar* in the *raga* Darbari or Todi, or the *shruti* of *komal rishabh* in the *raga* Bhairav. The following illustrations will show the way in which musicians actually use *shrutis* in a few *ragas*. The graphs have lines that correspond to the notes used in the *raga*. The number before the lines indicates the semitones – in which 0 = Sa, 1 = *komal* Re, 2 = *shuddh* Re, 3 = *komal* Ga 4 = *shuddh* Ga etc. The lines are at a multiple of 100 cents, i.e. *komal* Re = 100, *shuddh* Re = 200 etc., essentially representing a tempered system of 12 semitones. This representation does not imply that musicians actually use a tempered scale (although we shall see it often is a good approximation), but rather functions as a reference. Western scholars, from Ouseley (1800) and Paterson (1807), to Clements, Fox-Strangways and Danielou, identified the 3-*shruti* interval with the minor whole-tone (182 cents) and the 4-*shruti* interval with the major whole-tone (204 cents). This interpretation has led to a notion that *shrutis* represent a particular pitch position, a view that has also been adopted by many Indian scholars, from Pingle and Deval to Bose. This theory essentially assumes that semitones can be positioned at a low or a high position. In the case of the *ragas* discussed below there are the following possible positions:

Todi: *komal* Re at 90 or 112 cents, *komal* Ga at 294 or 316 cents (theoretically the positions for Multani would be the higher variant, for Todi the lower).

Ahir Bhairav: *komal* Re at 90 or 112 cents (would be *ati komal* = 90)

Darbari: *komal* Ga would be *ati komal* (294 cents). Note however, that if we consider Darbari's *shuddh* Re to be 204 cents (4-*shruti*), then a low position of Ga would imply an arrangement of 4+1+4 *shrutis*, which certainly is not warranted by Bharata.

The timescale on the x-axis is not shown in most of the examples, but 1 second is approximately 1.6 centimeters.

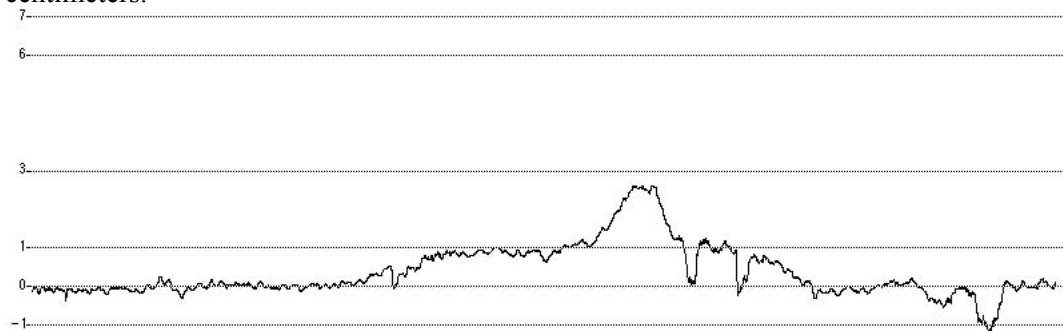


Figure 2: Mallikarjun Mansur, Todi

Examples 2 through 11 show the use of *komal* Re and *komal* Ga in the *raga* Todi, performed by Mallikarjun Mansur, Kishori Amonkar and Uday Bhawalkar. Todi's Ga is known to be a note, which is performed as a "*shruti*". Figure 1 shows how Mallikarjun creeps up slowly from Sa to Re, then again continues his journey upward to Ga, where he doesn't stay, but rather goes back to Re immediately. The Re also doesn't stand, it has two small touches of Sa and then merges into the tonic, which is graced by a touch of Ni. This initial statement of Ga is very significant as it stays beautifully some 20 cents below the 300 cents line. Notice how the first occurrence of Re is also slightly below the 100 cents line.

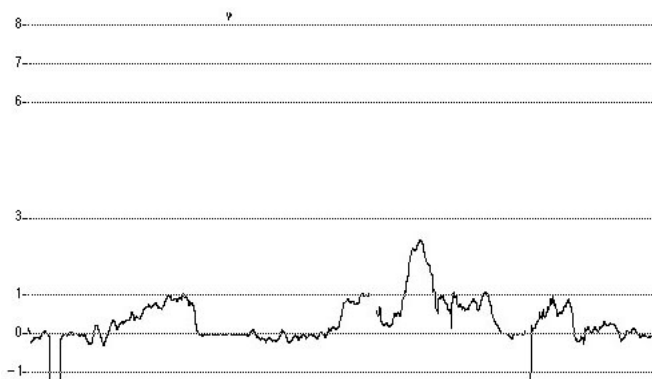


Figure 3: Mallikarjun Mansur, Todi

The second emanation of *Ga* is quite similar to the first, although the whole movement is executed faster. The pitch almost doesn't stay anywhere, it moves fluently from *Sa* to *Re*, back to *Sa*, again to *Re* and back to *Sa*, then directly to *Ga*, which is only touched upon. From there back to *Re*, to *Sa* to *Re* again and finishing on *Sa*.

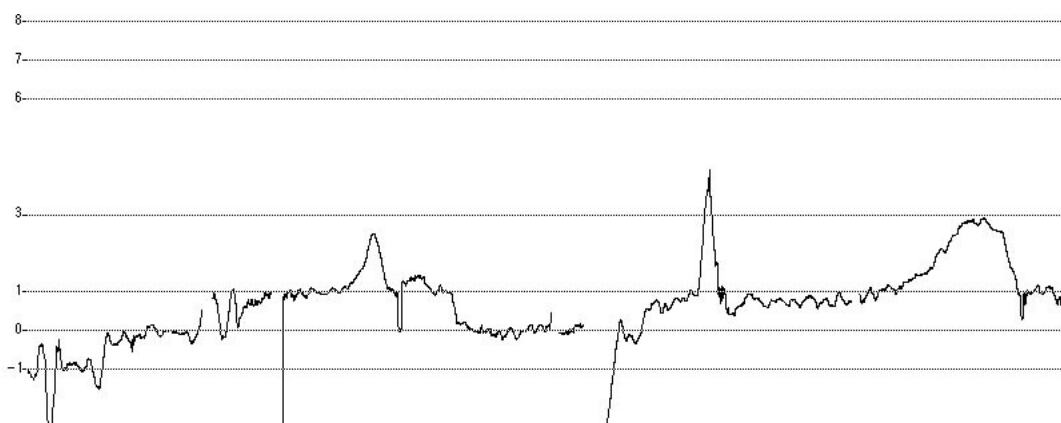


Figure 4: Mallikarjun Mansur, Todi

In the third example the *Ga* is attacked twice in sequence. It starts with a shake of *Ni*, moves to *Sa*, then with a double shake to *re*, creeping towards *Ga* and coming back to *re* and then *Sa*. The second attack is quite interesting, the big peak in the *Re* giving a hint of *tivra Ma* followed by a majestic rise from *re* to *Ga*. Notice that the hint of *tivra Ma* really doesn't even reach *shuddh Ma*. Notice also how the *Re* is quite low, whereas the bulge to *Ga* now almost reaches the 300 cent position.

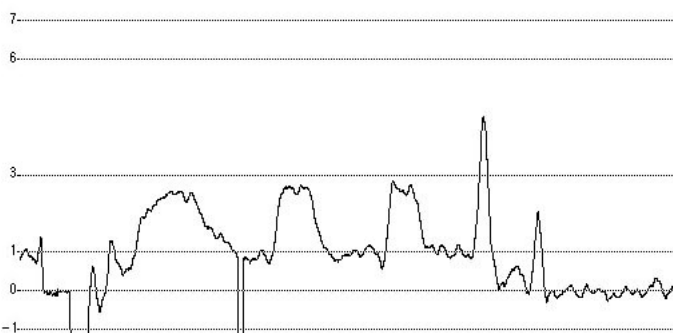


Figure 5: Mallikarjun Mansur, Todi

Now we see three bulges toward *Ga*, all remaining well below the 300 cents position. Here the hint of *tivra Ma* follows the *Ga*-s, as an afterthought that prepares us for what is to come next.

Summarizing it can be said that in the opening statements of *Re* and *Ga* both are often rather low, but in the course of the exposition they move upward. The essence however lies in the slow creeping of the voice from *Re* to *Ga* and then back to *Re*. This tonal configuration is what lends the *Ga* of Todi its special flavour. That this is not maintained when the melodic movements move upward is only natural, as *Re* and *Ga* are no longer the goal towards which the melody moves, but rather stand at the center.

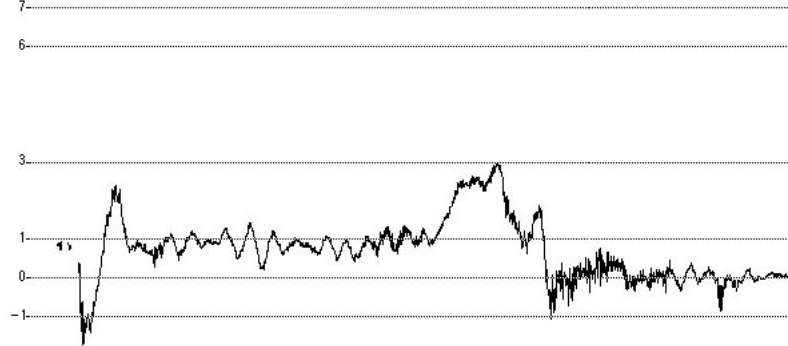


Figure 6: Kishori Amonkar, Todi

In a sense, the way in which Kishori portrays *Re* and *Ga* in this opening statement is very similar to what we have seen with Mallikarjun. Perhaps she draws out the movement a little more, creating a languorous mood that is so typical of Todi. Also, Kishori does some more pushing and pulling in the tonal space. *Re* is here preceded by very short touches of *Ni* and *Ga* (a *Ga* that really comes barely above *shuddh Re*). From the powerful *Re*, full of life from the vibrato, *Ga* is first shown in a very low position, but then, before returning to *Re* and *Sa*, *Ga* moves up just a little. The *Re* is so short that it is only a transition to *Sa*, but clearly demarcated because of the twist back in the direction of *Ga*.

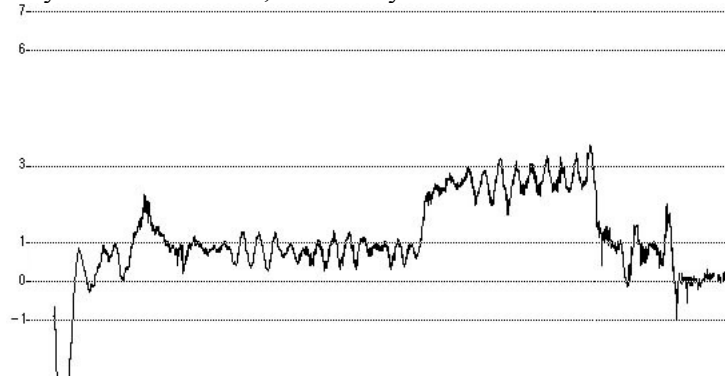


Figure 7: Kishori Amonkar, Todi

The second *Ga* is approached in a very similar way – a touch of a low *Ga* before *Re* and then a move to *Ga*. In this case however the vibrato on *Re* averages out at a rather low position, around 80 cents. The *Ga* really stands, which is rather different from Mallikarjun's *Ga*. Mallikarjun invariably returns to *Re* the moment he has reached *Ga*. Kishori lets us appreciate the *Ga* unabashedly. The vibrato gives it even more vigour. Notice how low it averages out, starting at no more than 260 cents. Notice also how the vibrato creeps upward to a position of nearly 290 cents. It takes a lot of control (and daring!) to portray Todi's *Ga* in this way.

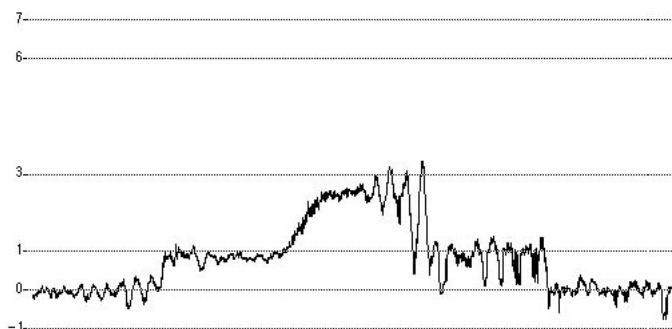


Figure 8: Kishori Amonkar, Todi

Again, the pattern is similar. First a low *Re* (90 cents), sliding into a very low *Ga* (260 cents), which ends with a vibrato before dropping back to *Re*. The descending *Re* averages out around 85 cents. Notice that it incorporates five very fast touches of *Sa*, that make it look like a vibrato, which it really is not.

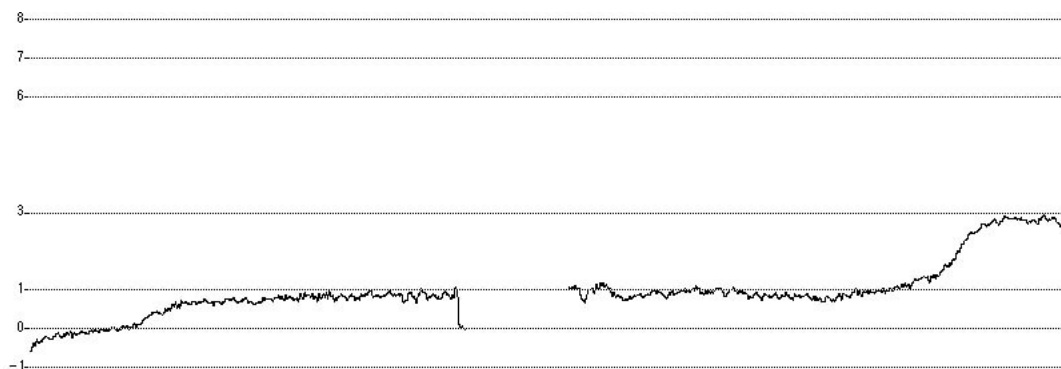


Figure 9: Uday Bhawalkar, Todi

Whereas the examples from Mallikarjun and Kishori were real live performances, Uday Bhawalkar has recorded a very short outline, in which the movements are shown in a more “didactic” vein. The opening statement shows a transition from *Sa* to *Re* followed by a movement to *Ga* that is strongly reminiscent of both Malikarjun and Kishori, but perhaps a little less ‘daring’. Notice that both *Re* and *Ga* are low, *Re* perhaps going from 70 to 90 cents, and *Ga* reaching about 290 cents.

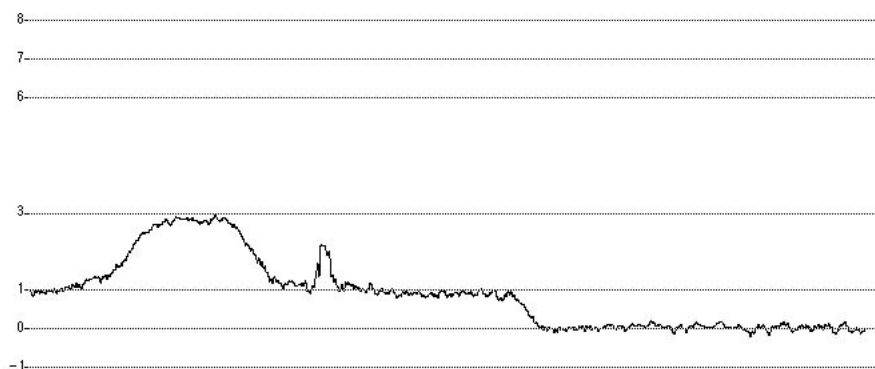


Figure 10: Uday Bhawalkar, Todi

This is the continuation of the movement seen in figure 10, sliding back to *Re*, giving a hint of *Ga* again (but really close to *shuddh Re*).

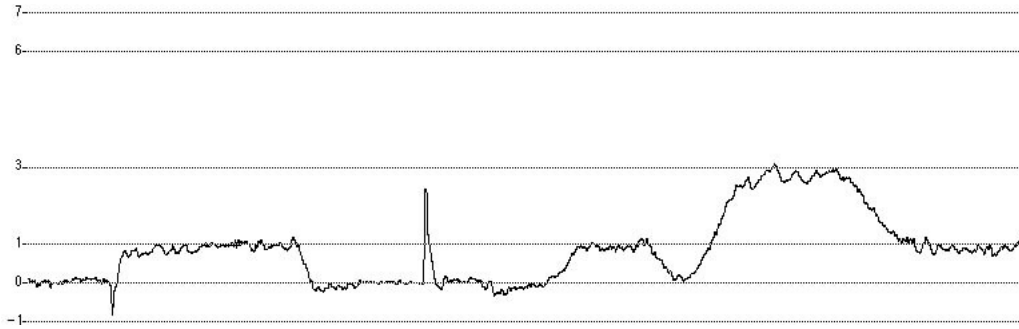


Figure 11: Uday Bhawalkar, Todi

Three *Re*-s and a *Ga*. The first *Re* creeps from 80 to 100 cents, there is a brief touch of *Ga*, then R-S-G, and sliding back to *Re*. Again *Ga*, comes close to 300 cents.

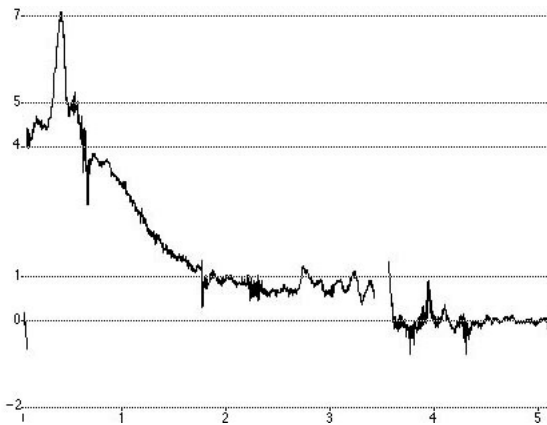


Figure 12: Kishori Amonkar, Ahir Bhairav

Bhairav is another classic showcase of the use of *shruti*. In particular the *komal Re* is supposed to be *ati komal*. In this fragment we see how Kishori makes a short grace of *GMPMG*, from where a *mind* slides down in a convex curve to *komal Re*. Reaching *Re* she pushes the voice downward a tiny bit, giving the characteristic dip that is sometimes considered to be part of an *andol*. After the short dip the *Re* moves back up a little with a vibrato at about 85 cents, followed by *Sa*.

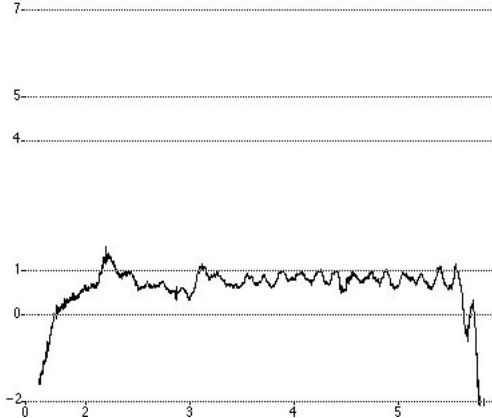


Figure 6: Kishori Amonkar, Ahir Bhairav

Coming from below we see the same pattern, *Re* has a small (in this case almost imperceptibly doubled) dip, which comes down to about 50 cents, before steadying out at 85 cents.

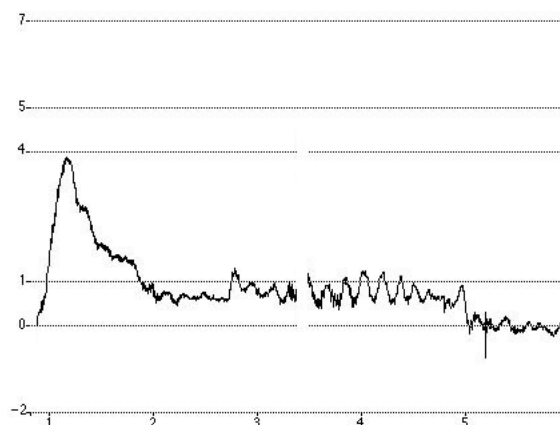


Figure 14: Kishori Amonkar, Ahir Bhairav

Here the *mind* comes from *shuddh Ga*, and the low dip of *Re* is at 60 cents. The vibrato stands at 80 cents.

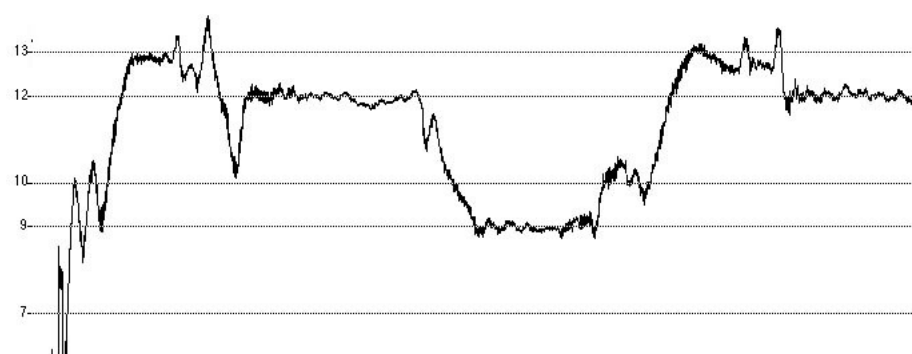


Figure 15: Kishori Amonkar, Ahir Bhairav

In the high octave the dips of *Re* are very similar to the middle octave.

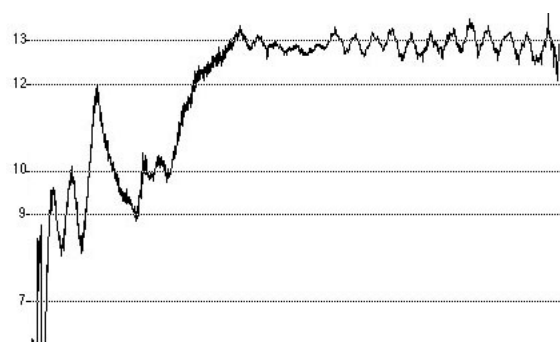


Figure 16: Kishori Amonkar, Ahir Bhairav

However, when the movements in the high octave become more powerful, the *Re* comes close to 100 (1300) cents.

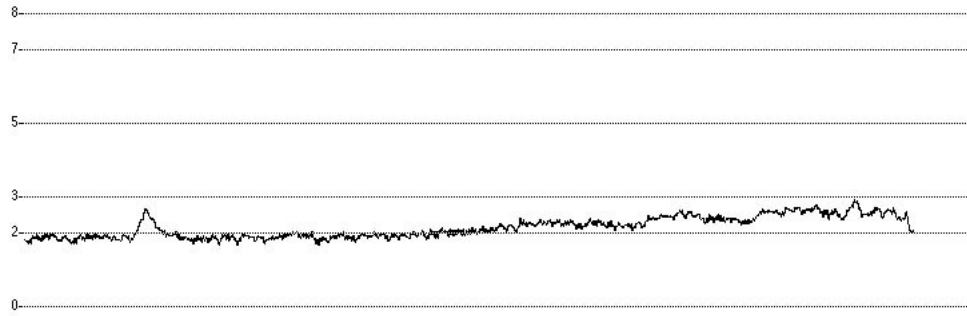


Figure 17: Uday Bhawalkar, Darbari

To conclude, we show a few examples of the use of *komal Ga* in the *raga* Darbari by Uday. Again, it must be noticed that the recording was made as a demo of the main movements of Darbari, not as a real performance. The first picture shows how Uday gives a very short touch of *Ga* to *Re*, followed by a seemingly endless creeping upward in the direction of *komal Ga*.

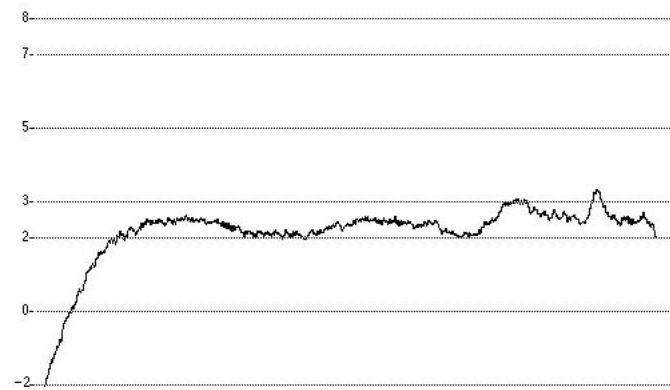


Figure 18: Uday Bhawalkar, Darbari

Perhaps the most typical way of using *Ga* in Darbari – really a slow moving back and forth between *Re* and *komal Ga*. This is the upward *andol*, in which *Ga* often stays somewhere in between *Re* and *komal Ga*, but gradually goes closer and closer to the 300 cents position.

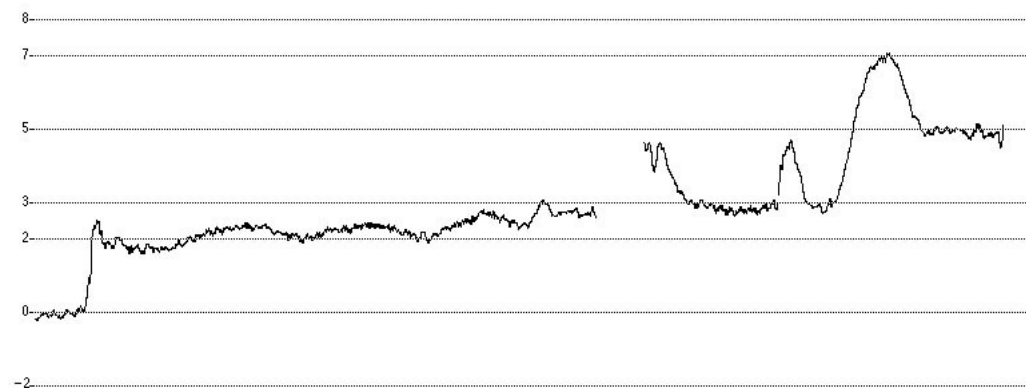


Figure 19: Uday Bhawalkar, Darbari

Almost the same beginning as in figure 18, but now followed by the *andol* linking *Ma* and *komal Ga*. Notice how the *Ma*-s are low in the beginning, but comes to a clear 500 cents after *Pa* has been touched.

Conclusion

Bharata's discussion of *shrutis* seem to refer to pin-point pitches with a fixed relation to each other. Medieval and post-medieval theorists continued to struggle with this interpretation of *shruti*, later given in terms of string lengths of the *vina*. Whereas, experimental studies conducted during the twentieth century provide evidence for flexible intonation ruling out the notion of pitch as fixed points. Modern scholars have observed intonation as a statistical phenomenon in which the note densities occur not as exact points but rather as limited ranges within a certain tonal region. The influence of melodic context on pitch is also clear from these studies.

The melodic graphs presented here clearly show that the use of the tonal space in *ragas* that are supposed to employ *shrutis* is not about fixed, pinpoint intonations. Rather, the artists attempt to carve out melodic shapes, in which the precise position of the movements can vary considerably. There is variation from one artist to another in the same *raga*, as each musician has his or her own way of portraying the characteristic movements. Moreover, each artist shows the movements in different ways within a single performance, often as a progression that 'colours in' the statement being made. It is a kind of story telling in which the main subject, the '*avirbhava*' is approached from various angles. Often, the note that is supposed to be dealt with as a *shruti* does not have a fixed pitch at all. In different occurrences it has a different pitch, but even within an occurrence it may be a 'moving' rather than a steady note. Even when the note is steady for a moment the various measured pitch levels do not conform to the pitch schemes that have been developed by a number of scholars who tried to equate Bharata's system with the major (*chatushruti*) and minor (*trishruti*) whole tone scheme. The tonal space is used in a far more imaginative way, often traversing the full 100 cent distance between two semitones. As such, the idea that the number of *shrutis* is infinite seems to be the only correct description.

The question may indeed be asked if *shruti* in contemporary Hindustani music is a form of ornamentation, rather than an aspect of pitch. This would however be a very limiting view, because ornamentation implies ornamentation of something – in particular a note. Therefore, to describe the usage of the tonal space as an ornament would imply the primacy of fixed notes that are being 'ornamented'. This is however not the case. Rather, the *shruti* is a phenomenon by itself, a tonal gestalt. In fact the greatness of some musicians comes out through the way they use the tonal space in time and magnify it in such a way that the relatively small distance of a semitone assumes vast proportions. As such, they feast our ears with a musical landscape that they describe to us in magnificent detail, with rivulets that meander through rolling foothills, and with pathways that lead through the highest mountain passes.

Hopefully, in the near future, advances in electronic and computer technology will enable us to add a third dimension of "colour" (including timbre and volume) to the above model of pitch in time, in order to evolve a holistic picture of "sound gestalt". In this context it is also important to understand the aesthetic considerations. There is no doubt that the propriety of intonation is not only culture-specific but is also guided by the aesthetic norms relating to various categories and genres of music within a culture.

It is important to emphasize that musicians have their own views on intonation, which are mainly handed down within the tradition. Maybe at times they are not consciously aware of certain academic issues and hence may not be in a position to express their ideas in terms of theoretical formulations. However, their ideas are implicit in musical practice as the musicians visualize tones, perhaps not as fixed points to be hit accurately every time, but rather in terms of tonal regions or pitch movements defined by the grammar of a specific *raga* and its melodic context. They also attach paramount importance to certain *raga*-specific notes within phrases to be intoned in characteristic ways. Hence, we need to understand what the performers have in mind about their intonation and how they relate these concepts to the actual intonation. The inclusion of these principles would help us to arrive at an explicit model for the study of intonation relating to contemporary North Indian *raga*-performance.

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